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Method of Using Removable Cleat System

Field of the Invention

This invention relates to the mounting of traction gear on the bottom of footwear, in particular, athletic footwear.

Background Art

Conventional traction gear presently in use employ an attachment means consisting of screwing the traction gear into the mated receiving receptacle in the bottom of the footwear. Using this screw-type attachment method is especially laborious when one takes into account that a typical golf shoe, for instance, has eleven cleats; as a result, replacing the cleats on a pair of golf shoes entails unscrewing twenty-two cleats and screwing on twenty-two cleats, where each act of unscrewing or screwing entails several turns, typically two and one-half times, for each cleat.

An example of a typical prior-art cleat is in U.S. Pat. No. 4,723,366 (hereinafter the '366 cleat), which patent is incorporated herein by reference. This patent describes a cleat which includes a metal stud infrastructure at the core of the cleat, the infrastructure having a vertical axis and two ends, a screw portion at a first end for engagement with a receptacle within a shoe, a ground end for tractive engagement with the ground, and a broad flange between the screw and head portions and extending radially outward from the vertical axis; a plastic skirt is molded directly upon the flange portion to form a unitary reinforced radial support member of the cleat. Installation of the '366 cleat consists of screwing it into a mated receptacle in the bottom of athletic footwear.

Although some prior-art references show cleat-attachment systems that require less than a full turn, or they require a snap-on arrangement to lock the cleat in place, it appears

none of these systems have found wide acceptance amongst users because of shortcomings in stability, ease-of-use, receptacle size and ease-of-manufacture. For instance, in U.S. Patent No. 4,633,600 to Dassler, a cleat attachment system is disclosed in which a snap ring socket is utilized to affix a cleat to the bottom of a shoe.

In U.S. Patent No. 3,267,593 to Turner, a cleat attachment system is disclosed wherein the top of the cleat spike has two extensions forming a rough T-shape out of the spike, where the spike is inserted into a mated receptacle having two grooves to receive the extensions. Upon complete insertion of the spike into a receptacle, the spike is turned until the extensions drop into receiving grooves at the top of the receptacle; a retaining ring is then slid onto the mid-section of the spike, this ring apparently preventing the spike from unseating the extensions from the grooves.

Similarly, in German Patent Application Nos. DE3134817A1 to Sportartikelfabrik Karl Uhl GmbH, and DE3423363A1 to Gebrüder Goldschmidt Baubeschläge GmbH, another T-spike design is disclosed in which internal to the mated receptacle are ramping means for engaging and retaining the spike extensions. In the former, a rough interior surface catches the extensions, while in the latter, a sloping interior engages the extensions.

U.S. Patent No. 4,492,047 to Arff, discloses another T-shape spike in which the skirt is deformed during insertion. Insertion of the spike causes the extensions to go up a ramp and then down a ramp, pulling the spike into the receptacle, and leaving the extensions in a holding area. The skirt is deformed so as to result in a pressure against the socket, the pressure apparently holding the spike from accidentally traveling back up the ramp towards removal.

In U.S. Patent No. 4,035,934 to Hrivnak, another T-shape spike is disclosed in which the spike column has two indentations. During installation, two spring arms, each positioned perpendicular to the surface of the shoe and parallel to the spike, are pressed in during insertion of the spike, and spring back out to press against the indentations upon complete

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insertion. Removal of this spike is achieved with a U-shaped tool which slides into the spike receptacle and pushes in the spring arms, thus freeing the spike for removal.

Summary

A representative embodiment of the present invention includes a method of installing a removable cleat to the sole of a shoe. The method includes providing a cleat having (1) a ground-engaging structure for engaging the ground; and (2) an attachment structure for removably attaching the cleat to the footwear. The attachment structure has a vertical axis, a base to which the top of the ground-engaging member is attached, and a plurality of extensions attached to the base. A receptacle is provided for receiving and holding the cleat, the receptacle being mounted in the sole of a shoe. The receptacle has (1) a wall defining a cavity between a receptacle top and a receptacle bottom, wherein portions of the wall extend radially inward toward a central vertical axis of the receptacle so as to define: (i) a plurality of inclines within the cavity, and (ii) a plurality of protuberances within the cavity, each protuberance extending radially inward toward the vertical axis further than the compressible inclines; (2) a restraining ledge attached to the receptacle bottom and extending into the cavity so as to prevent downward movement of an installed cleat; and (3) an opening in the restraining ledge having at least three equidistantly spaced radially projecting lobes that extend radially outward from the central vertical axis of the receptacle. The cleat extensions are inserted through the receptacle opening into the receptacle cavity. Then, the extensions are engaged above the restraining ledges so that the cleat is securely attached to the receptacle so as to resist rotational movement of the cleat.

In a further embodiment, each cleat extension may have a radial end and an angled indentation located towards the radial end, and the act of engaging may include engaging each angled indentation with an incline. The plurality of cleat extensions may be equidistantly spaced. Also, the plurality of cleat extensions may lie in a plane perpendicular

to the vertical axis of the attachment structure. The cleat may further include a skirt located between the top of the ground-engaging structure and the bottom of the attachment structure base, the skirt extending radially outward beyond the radial ends of the extensions so that when the cleat is attached to the receptacle, the skirt covers the opening in the restraining ledge.

The skirt may include a plurality of openings on the ground-engaging structure side of the skirt so that a cleat wrench may be inserted into the skirt openings to maneuver the cleat. Each incline may have a relatively gradual front ascent portion and a relatively steep back descent portion. Engaging the extensions may include securing each extension between an incline and a protuberance so as to resist rotational movement of the cleat.

Another representative embodiment includes a removable cleat for a shoe. The cleat includes a ground-engaging structure for engaging the ground; and an attachment structure for removably attaching the cleat to the footwear. The attachment structure has a vertical axis, a base to which the top of the ground-engaging member is attached, and a plurality of extensions projecting radially outward from the base. The extensions are adapted for insertion into a cleat receptacle in the shoe to engage a receptacle attachment structure within the receptacle, so that when the cleat is attached to the receptacle, each cleat extension will be securely engaged above a receptacle restraining ledge.

In a further such embodiment, the attachment structure engaged by the cleat extensions includes an incline and a protuberance for each cleat extension, arranged so that when the cleat is attached to the receptacle, each cleat extension is secured between an incline and a protuberance so as to resist rotational movement of the cleat. Each incline may include a relatively gradual front ascent portion and a relatively steep back descent portion. Each protuberance may extend radially inward toward the vertical axis of the attachment structure further than the compressible incline. Each extension may have a radial end and an angled indentation located towards the radial end, the angled indentation being adapted to engage a corresponding incline when the cleat is attached to the receptacle.

The plurality of cleat extensions may be equidistantly spaced. The plurality of cleat extensions may lie in a plane perpendicular to the vertical axis of the attachment structure. The cleat may further include a skirt located between the top of the ground-engaging structure and the bottom of the attachment structure base, the skirt extending radially outward beyond the radial ends of the extensions so that when the cleat is attached to the receptacle, the skirt covers the receptacle.

The skirt may have a plurality of openings on the ground-engaging structure side of the skirt so that a cleat wrench may be inserted into the skirt openings to maneuver the cleat.

Brief Description of The Drawings

The following drawings are intended to provide a better understanding of the present invention, but they are in no way intended to limit the scope of the invention.

FIG. 1 is a side view of a cleat according to one embodiment of the invention.

FIG. 2 is a top view of the cleat of FIG. 1, showing the shape of the lobes to be inserted into a mated receptacle in the bottom of athletic footwear.

FIG. 3 is another side view of the cleat of FIG. 1.

FIG. 4 is a bottom view of the cleat of FIG. 1.

FIG. 5 is a bottom view of a receptacle that may receive the FIG. 1 cleat.

FIG. 6 is a top section view of the FIG. 5 receptacle wherein the top layer of the receptacle has been removed.

FIG. 7 is a side vertical section of the receptacle of FIG. 6.

FIG. 8 is a top view of the FIG. 6 receptacle wherein the top layer has not been

removed.

FIG. 9A is a perspective right side view of a cleat according to a preferred embodiment of the invention.

FIG. 9B is a perspective top view of the FIG. 9A cleat.

FIG. 9C is a perspective front view of the FIG. 9A cleat.

FIG. 9D is a perspective left view of the FIG. 9A cleat.

FIG. 10 is a top view of the cleat of FIG. 9A, showing the shape of the lobes to be inserted into a mated receptacle in the bottom of athletic footwear.

FIG. 11 is another side view of the cleat of FIG. 9A.

FIG. 12A is a top section view of a the receptacle for receiving the cleat of FIG. 9A, wherein the top layer of the receptacle has been removed.

FIG. 12B is a perspective bottom view of the FIG. 12A receptacle.

FIG. 13 is a side vertical section of the receptacle of FIG. 12A.

FIG. 14 is a bottom view of a cover for the FIG. 12A receptacle.

FIG. 15 is a side view of FIG. 14 cover.

FIG. 16 is a partial view of a FIG. 9A cleat inserted into a FIG. 12A receptacle.

FIG. 17 is a bottom view of the FIG. 9A cleat.

FIG. 18 is a top view of an unassembled receptacle for receiving the FIG. 9A cleat.

FIG. 19 is a bottom view of the FIG. 18 receptacle.

FIG. 20 is a section view of the FIG. 18 receptacle.

FIG.21 is a side view of a cleat according to a preferred embodiment of the invention.

FIG.22 is a side view of a cleat according to a preferred embodiment of the invention showing an alternative ground-engaging "soft" golf spike.

FIG. 23 is a top view of a cleat similar to FIG. 21 showing the top of the cleat connector.

FIG. 24 is a perspective top view of the cleat of FIG. 21 in a receptacle with the top cover removed.

FIG. 25 is a top view of a cleat connector of the type shown in FIG. 23, with the addition of semi-circular dust covers.

FIG. 26 is a perspective top view of the cleat connector of FIG. 25.

FIG. 27 is a perspective bottom view of a preferred embodiment of a receptacle for receiving the cleat connector of FIG. 25.

FIG. 28 is an inverted side view of a cleat using the cleat connector of FIG. 25.

FIG. 29 is a perspective bottom view of an alternative receptacle having a center cone in the top cover.

Detailed Description

The invention comprises a system for allowing the quick attachment and release of a wide variety of traction gear. FIG. 1 shows that in one embodiment of the invention, the attachment system would be used to attach cleats, such as those disclosed in U.S. Pat. No. 4,723,366, to the underside of athletic footwear. a cleat installed in the bottom of a shoe using the present invention, when viewed from the bottom, has a similar appearance to the

preferred embodiment of the invention disclosed herein. Evident in FIG. 1 are the bottom side **17** and top side **16** of the plastic skirt **15**, the ground-engaging head portion **10** of the cleat, a base **13** to which the plastic skirt and ground-engaging portion are attached and a retaining member **20,** which in this case is a base **13** with three rounded extensions **22**, all of which are positioned around a central axis **28**. In a preferred embodiment of the invention, the top **16** of the skirt **15** is slightly concave, and the bottom **17** of the skirt **15** is somewhat convex.

FIG. 2 shows the topside **16** of the cleat skirt **15** and the retaining member **20**, which has a roughly triangular shape with indentations **26**. The extensions **22** of the retaining member **20** are used in conjunction with components inside the receptacle, shown as item **30** in FIG. 5, for locking in place a properly inserted retaining member **20**. Locking in place occurs after inserting the retaining member **20** into a mated receptacle opening **40** as shown in FIG. 5 and FIG. 6, and torqueing the retaining member. The extensions **22** are attached to the base **13** (shown in FIG. 1), and together the extensions and the base form the retaining member **20**. In a preferred embodiment of the invention, a completed cleat, comprising the retaining member **20** and traction gear, is made out of plastic with a metal core used to reinforce the structure. Although the invention could be made entirely out of metal, it is preferable that the cleat be made partially of plastic and partially of metal. When the retaining member is plastic, the retaining member may be integrally formed with a plastic skirt of a golf cleat with a core, preferably metal, extending through the retaining member and the traction gear to form the ground-engaging head portion **10** shown in FIG. 1.

In a preferred embodiment of the invention, upon insertion of the retaining member **20** into a receptacle, the angled surface **24** (shown in FIG. 1) of the extensions **22** allows for a tighter fit of the retaining member **20** into the receptacle **40** (shown in FIG. 5). The tight connection not only serves to give a stable connection between the shoe and traction gear, but also serves to keep moisture and debris out of the attachment system.

FIG. 3 is another view showing the structure and proportion of the retaining member **20** as attached to traction gear **21**. FIGS. 2 and 3 show that in a preferred embodiment of the invention, the extensions **22** form a broad retaining member **20**, and the base **13** is cylindrical and concentrically disposed around the center axis **28**; the base **13** is attached to the extensions **22** and the traction gear **21**.

FIG. 4, a bottom view of the FIG. 1 cleat, shows that, in a preferred embodiment of the invention, cleats do not have to be redesigned beyond modifying the retaining member **20** (shown in FIG. 1), and that conventional cleat designs are intended to be used in conjunction with the new retaining member; once a cleat is installed, the change in the retaining system is not apparent. A standard golf-cleat wrench may be used to engage the traction gear through use of the wrench holes **18**.

FIG. 5 is a bottom view of a receptacle **30** that may receive the FIG. 1 cleat, showing the receptacle opening **40**, with indentations **44** along its perimeter for accepting the retaining member extensions **22** (shown in FIG. 1). FIG. 5 also shows the ledges **46** that while serving to form the shape of the opening **40**, also serve to hold the extensions **22** within the receptacle. Although preferred embodiments of the invention include a single receptacle opening **40**, alternate embodiments of the system could have a receptacle with separate openings for receiving extensions.

FIG. 6 is a section view of FIG. 5 where the top layer of the receptacle has been removed to show the inner-cavity structure for receiving the retaining member **20** (shown in FIG. 1). Within the cavity, formed by wall portion **50**, there are several cantilevered fingers **51**, or spring arms, that are designed to grip and hold an installed retaining member. When a retaining member is inserted into the indentations **44** and twisted, the twisting action causes a protruding edge of an extension **22** (shown in FIG. 1) to push into and bend the finger **51** to allow the extension to be turned past the location of the finger. Once the protruding edge of an extension passes the location of the finger, the finger springs back to nearly its original

shape, so that surface **53** rests against the perimeter of the extension **22**. This allows the cleat to be removed, but only by exerting sufficient force to bend the finger **51** away from the surface of the extension **22**, an arrangement requiring much greater torque than that required during installation of the retaining member. In one embodiment, the fingers are elongated in shape, with surface **53** forming a curved tip to the finger. FIG. 6 also shows bumps **55** which serve as a means for preventing a retaining member from being turned too far. In a preferred embodiment, the cleat should not be turned more than about 60°. Coincident with the fingers **51** locking into place, the protruding edge of an extension is blocked from further movement by the bumps **55**, and the entire retaining system is prevented from falling out of the receptacle by ledges **46**. FIG. 6 also shows one method of attaching the receptacle to the underside of footwear by the use of mounting holes **57**.

Spacing within the receptacle may be designed such that during installation of a cleat, the cavity **40** in which the extension is turned gradually narrows to compress and securely hold the cleat in place. Preferably the spacing is consistent or more gradual than the angled surface, so that the angled surfaces **24** (shown in FIG. 1) of the extension **22** being pressed against the ledges **46** cause the fit to be tight. In addition, having three extensions parallel to the cleat skirt makes for a more secure base for a cleat.

FIG. 7 is a vertical section of a portion of the embodiment of the receptacle of FIG. 6. This view shows the ledge **46** formed by the bottom layer **45** of the receptacle and the wall portion **50** that defines the cavity within the receptacle. This view also shows the slight rise **48** which forms a lip at the receptacle opening so that the edge of an installed cleat's skirt may overlay the lip. The lip helps hold the cleat in place and makes it more resistant to lateral forces while the cleat is in use.

FIG. 8, which is the FIG. 6 receptacle where the top layer has not been removed, is a view from the top of the receptacle **30** in accordance with a preferred embodiment of the invention. This view shows the top side **67** of the mounting holes for attaching the

receptacle.

FIGS. 9A-9D, 10 and 11 show a preferred embodiment of a cleat having the same basic characteristics and structural concerns of the FIGS 1, 2, and 3 embodiments discussed herein above. Evident in FIG. 9A are the bottom side **17b** and top side **16b** of the plastic skirt **15b**, the ground-engaging head portion **10b** of the cleat, a base **13b** to which the plastic skirt and ground-engaging portion are attached and a retaining member **20b,** which in this case is a base **13b** with three rounded extensions **22b**, the extensions having an angled surface **24b** and being positioned around a central axis **28b**. FIGS. 9B-9D are respectively the perspective top, front, and left view of the FIG. 9A cleat.

Evident in FIG. 10 are the corresponding topside **16b** of the cleat skirt **15b** and the retaining member **20b**, with indentations **26b**. The extensions **22b** of the retaining member **20b** are used in conjunction with components inside the receptacle **84** of FIG. 12A, for locking in place a properly inserted retaining member **20b**. Locking in place occurs after inserting the retaining member **20b** into a mated receptacle opening **40b** shown in FIG. 12A, and torqueing the retaining member. As with the FIG. 1 embodiment, upon inserting the retaining member **20b** into a receptacle **84**, the angled surface **24b** (shown in FIG. 9A) of the extensions **22b** forces a gradual compression of the retaining member **20b** as it is inserted into the receptacle cavity **40b**, resulting in a tight connection giving stability while also serving to keep moisture and debris out of the attachment system.

Also evident in the FIG. 10 embodiment is a modification to the FIG. 2 embodiment, where the extensions **22** of FIG. 2 are modified to include an indentation **70** that further enhances the invention's resistivity to unlocking and its unintentional removal through normal use. Increased resistivity is effected by an interlocking of a cantilevered finger **74** (shown in FIG. 16) with the indentation **70**. The cantilevered finger **74** corresponds to the cantilevered finger **51** of the FIG. 6 embodiment, in which the cantilevered finger **51** has been thickened to afford a greater resistivity to unintentional unlocking. Further, upon

complete insertion of the retaining member **20b** into an appropriate receptacle **84** (shown in FIG. 12A), the end portion **90** of the cantilevered finger **74** rests within the indentation **70**. Consequently, removal of the cleat requires greater torque than that required to install the cleat.

FIG. 11 is another view showing the structure and proportion of the retaining member **20b** as attached to traction gear **21b**, indicating the location of indentation **70**, as well as showing that the placement of the retaining member **20b** and base **13b** is concentrically disposed around the center axis **28b**.

FIG. 12A is a section view of a preferred embodiment of a receptacle for receiving the cleat of FIGS. 9A-9D, 10 and 11, where the top layer of the receptacle **84** has been removed to show the inner-cavity structure for receiving the retaining member **20b** (shown in FIG. 9A). FIG. 12B shows a perspective view of the FIG. 12A receptacle. As with the FIG. 6 embodiment, included within the cavity, formed by wall portion **78**, are several cantilevered fingers **74** designed to grip and hold an installed retaining member **20b**. When a retaining member is inserted and twisted, the twisting action causes a protruding edge of an extension **22b** to push into and bend the finger **74** to allow the extension to be turned past the location of the finger. Once the protruding edge of an extension passes the location of the finger **74**, the finger springs back to nearly its original shape, so that surface **90** contacts the perimeter of the extension **22b**. As described herein above, when the surface **90** contacts extension **22b**, there is an interlocking of cantilevered finger **74** with the indentation **70** (shown in FIG. 10). This allows the cleat to be removed, but only by exerting sufficient force to disengage and bend finger **74** away from indentation **70** and the surface of the extension **22b**, an arrangement requiring much greater torque than that required during installation of the retaining member. As with the FIG. 6 embodiment, the fingers are preferably elongated in shape, surface **90** forms a curved tip to the finger, and bumps **55b** serve as a means for preventing a retaining member from being turned too far during

insertion.

Also evident in the FIG. 12A receptacle is another preferred embodiment for attaching the receptacle **84** to the underside of footwear by the use of a mounting slot **80**. In this embodiment, the perimeter **100** of the receptacle **84** comprises three flanges disposed around the receptacle opening **40b**. In preferred embodiments, within each flange **82** of the perimeter are two slots **80** for mounting the receptacle **84** to footwear. Mounting of the receptacle is by methods known in the prior art, and may include forming sole material around the slots, or inserting a pin or other object through the slot to effectively nail the receptacle to an inner-sole of a shoe, and then forming the outer-sole material around the receptacle so affixed. The slots **80** are separated by a pre-determined distance and are preferably curved to conform to the curvature of the flange **82** in which the slot **80** is set. Also shown are three openings **88** to allow for attaching a receptacle cover **96** (shown in FIG. 14) to the receptacle **84**.

FIG. 13 is a vertical section of a portion of the embodiment of the receptacle of FIG. 12A. The FIG. 13 embodiment has a ridge **76** has been added in the bottom layer **86** of the wall portion **78** of the receptacle. In this preferred embodiment, the ridge **76** is located upon the downward side of the receptacle and helps assure mold seal-off. Sealing off the mold helps prevent sole material from the outsole molding process from accidentally spilling in over the bottom-end of the receptacle during production. (The receptacle and outsole are preferably molded ground-side up.) In addition, by adding ridge **76** to the basic design of FIG. 6, the structure of the FIG. 6 receptacle is strengthened, making it less susceptible to torques, distortions, or other forces. This results in better retention of the receptacle within the sole of athletic footwear.

FIG. 14 shows a receptacle cover **96** having three holes **92** corresponding to the three openings **88** shown in FIG 12. In preferred embodiments, the receptacle cover is designed to attach to and seal the top end of the receptacle **84** of FIG. 12A, so that during molding of a

shoe sole around the receptacle, the sole material does not seep under the top edge of the receptacle and fill its cavity. In addition, at the center of the cover **96** is a dome **94**. This dome hangs downward from the top of the receptacle, into the receptacle cavity for receiving a retaining member **20b** (shown in FIG. 9A).

FIG. 15 shows a side view of the FIG. 14 cover, indicating the extent of the dome **94** with respect to the rest of the cover's **96** proportions. The dome forms a cavity **98** between a sole of a shoe and the top of the receptacle **84** (shown in FIG. 12A). In preferred embodiments, during manufacture of a shoe sole, in addition to sole material being molded around the receptacles, sole material is also allowed to fill in the cavity **98**. Consequently, as a retaining member **20b** (shown in FIG. 9A) is inserted into a proper receptacle, the insertion forces a compression of the dome which in turn compresses the sole material filling the dome. The dome **94** serves two purposes. First, when the retaining member **20b** of traction gear is fully installed within a receptacle **84** (shown in FIG. 12A), the compression of the dome results in a downward pressure upon the extensions **22b** from the dome trying to re-expand into its original shape. Second, when one tries to remove the traction gear from the receptacle **84**, the re-expansion of the sole material helps push the retaining member away from the sole, thus aiding in the removal of attached gear.

In preferred embodiments, the extensions for the attachment system are molded using conventional molding processes. Preferably, the molding process uses mold components having expandable cavities, these cavities allowing for undercuts to be molded without the use of side actions or slides. The receptacle may be molded using conventional molding processes, where the receptacles are preferably produced on a horizontal or vertical press and, with the aid of precision mold design and building, are formed in a manner well-known in the art.

In preferred embodiments of the invention, during manufacture, the receptacle portion with the top cover attached is placed in an outsole mold, and the ground surface part

of a shoe is then molded. The molding process is preferably one of injection or compression molding. The particular location of each receptacle within the mold depends on the intended use of the shoe and the design of the shoe's shape. During manufacture of the outsole of one embodiment of the invention, mold support-braces may be used to help ensure no deformation of the receptacles during the molding of the sole. Preferably, the support-braces are negatives of the receptacle's shape such that when a brace is inserted into a receptacle, the receptacle **84** and pin holes **88** (shown in FIG. 12A) are temporarily sealed off to prevent sole material from filling in the receptacle cavity **40b** and pin holes **88**. These pins may also be used to help orient and position the receptacle so that sole material flows up to and not beyond the ridge **76** (shown in FIG. 13) that is visible on the ground side of the receptacle. Once the outsole is molded, a second material may be molded or cemented to the outsole, and also cemented to the upper portion of the shoe. In this embodiment, the outsole and second material combination form a completed sole having the embedded receptacles.

In some embodiments, the shoe sole may be formed of light-weight materials such as EVA or foam. In such embodiments, the sole material may be insufficiently strong to hold a receptacle firmly in place. Consequently, in preferred embodiments, a support plate may be added to the sole structure, wherein the receptacles are attached to the plate at the desired locations, and the sole is formed around the attached receptacles. Such plates may also be used for heel support for footwear having light-weight heels; similarly, for heel-plates, support-pins may also be used to help prevent heel receptacle deformation.

FIG. 16 is a partial view of a FIG. 9A cleat inserted into a FIG. 12A receptacle. Shown is a magnified view of the tip **90** of a cantilevered finger **74** at rest in indentation **70** of retaining member **20b**. As described herein above, after installation of a cleat into a receptacle, the torque required to dislodge the cantilevered finger **74** from the indentation **70** is much greater than that required during installation.

FIG. 17, a bottom view of the FIG. 9A cleat, shows that in this embodiment of the

invention, a three-pronged wrench is inserted into the three wrench holes **110** used to remove the cleat. Use of a three-wrench-hole design gives greater stability during insertion and removal of a cleat, and allows greater torque to be applied, without slipping out of the holes, during such insertion and removal.

FIG. 18 is a top view of an alternate embodiment where a modified FIG. 14 cover is attached to the FIG. 12A receptacle through a flexible attachment region **120**. In this embodiment, the receptacle **84** and cover **96** may be integrally formed of a single portion of production material, and simultaneously formed from a single mold. Before insertion of this embodiment of the receptacle into a shoe sole, the cover is flipped closed to cover the top of the receptacle. The FIG. 14 cover is modified to include two cover flanges **122** which, when the cover is closed, rest in-between two of the receptacle flanges **82**. The cover flanges **122** also have slots **124**, which in addition to the receptacle slots **80** described herein above, are used for mounting the FIG. 18 combined receptacle and cover to the underside of footwear.

FIG. 19 is a bottom view of the FIG. 18 embodiment, showing the ridge **76** (see FIG. 13 herein above) which helps prevent sole material from the outsole molding process from accidentally spilling in over the bottom-end of the receptacle opening **40b** with attached FIG. 14 cover having the features as disclosed herein above for FIG. 12A and FIG. 14.

FIG. 20 is a top section view of FIG. 18, showing the relationship between the extent of the dome **94** and the receptacle **84**. Also shown is the region defined by portions **126**, **128** for receiving the cover flange **122** when the cover is closed over the receptacle **84**.

FIG. 21 shows a side view of an alternative embodiment of a cleat having some of the same basic characteristics of the FIGS. 1, 2, and 3 embodiments discussed herein above. Evident in FIG. 21 are a bottom **201** of a plastic skirt **203**, and a top **205** with receptacles **207** for a cleat wrench. The cleat also has a ground-engaging spike **209** and a base **211** to which the skirt **203** and the spike **209** are attached. FIG. 22 is a side view of another cleat with a cleat connector similar to FIG. 21 showing an alternative ground-engaging "soft" golf

spike **225**. FIG. 23 is a top view of the cleat connector of the cleats in FIGS. 21 and 22 showing retaining member **213**, which in this case is the base **211** with three thermoplastic extensions **215** projecting radially outward in a direction perpendicular to a vertical axis **210** of the base **211** in FIG. 21. Each extension **215** has a front side **217** approximately parallel to a radial midline **218** of the extension **215** and which extends from a radial end **220** of the extension **215** back towards the vertical axis **210** of the base **211**. Each extension **215** also has a back side **219**, roughly parallel to and substantially shorter than the front side **217**; the back side **219** is also closer to the midline **218** of the extension **215** than the front side **217**. The back side **219** extends back from the radial end of the extension **220**, partway to the base **210** until it joins another surface **221** which is substantially perpendicular to the radial midline of the extension **218**, so as to form an L-shaped indentation **222**. In a preferred embodiment, the extensions **215** all lie in the same plane, and each extension **215** is equidistant from the adjacent extension.

FIG. 24 is a perspective top view of a preferred embodiment of a receptacle **251** for receiving the cleats of FIGS. 21, 22, and 23 with the top cover removed to show the inner-cavity structure for receiving the retaining member, **213** in FIG. 23. Within a cavity **253**, formed by wall portion **255**, are several protuberances **257** designed to grip and hold an installed retaining member **213**. When a retaining member **213** is inserted and twisted, the twisting action rotates the front side **217** of an extension **215** past a protuberance **257** so that the radial end **220** of the extension **215** compresses the protuberance **257**, allowing the extension **215** to turn past the protuberance **257**. The extension **215** can continue to rotate until the front side **217** of the extension **215** engages a stopping wall portion **259** of the cavity **253**. The receptacle **250** is designed so when the front side **217** of an extension **215** engages a stopping wall portion **259** of the cavity **253**, the protuberance **257** springs back to nearly its original shape and snugly engages the L-shaped indentation **222** on the back side **219** of the extension **215**. Each extension **215** of an installed cleat, therefore, is firmly held

in place between a stopping wall **259** and a protuberance **257** so that the retaining member **213** is securely attached to the receptacle **250**.

Removal of the cleat requires rotation in the opposite direction from installation. In a preferred embodiment, the protuberances **257** and the radial ends **220** of the extensions **215** are shaped so that rotation of the cleat in the removing direction requires much greater torque than that required during installation. For example, the radial ends **220** of the extension **215** may be tapered on the front side, **223** in FIG. 23, so that the radial end more easily rides over and compresses the protuberance during installation. Without a taper on the back side **224** of the radial end of the extension **215**, substantially greater force is required for the radial end **220** to ride over and compress the protuberance **257** when rotation is in the removing direction. Alternatively, the protuberances **257**, rather than the extensions **215**, may be tapered to allow easier rotation in the installation direction and require greater force for rotation in the removing direction.

FIG. 25 is a top view of a cleat connector **260** of the type shown in FIG. 23, with the addition of semi-circular dust covers **261** between each extension **215**. Of course, the cleat connector **260** may be placed on top of a wide variety of surface engaging structures including both surface penetrating structures and non-surface penetrating structures. FIG. 26 is a perspective top view of the cleat connector **260** of FIG. 25, and FIG. 27 is a perspective top view of a preferred embodiment of a receptacle **262** for receiving the cleat connector **260** of FIG. 25. To install the cleat, the connector extensions **215** are inserted into the receptacle's semicircular openings **263**. The cleat is rotated into place to engage the structure of the connector **260** with the internal structure of the receptacle **262** as described above with respect to FIGS. 23 and 24. This also rotates the dust covers **261** towards the receptacle openings **263**. As the connector **260** locks into place in the receptacle **262**, the dust covers **261** settle snugly into the receptacle openings **263** to seal the openings **263** so as to prevent the entry of debris from the ground into the receptacle **262**.

As shown in FIG. 28, the dust covers **261** may have an incline so that as the connector **260** rotates into place in the receptacle **262**, the leading edge **264** of the dust cover **261** is lower, or closer to the base of the connector **260** than is the trailing edge **265** of the dust cover **261**. As a result, as the cleat is rotated, the dust cover **261** initially rotates easily over the opening **263** of the receptacle **262**. Before the structure of the connector **260** locks into engagement with the internal structure of the receptacle **262**, the higher trailing edge **265** of the dust cover **261** becomes compressed by the edge of the opening **263** of the receptacle **262** increasing the amount of force required to rotate the cleat. Just as the structure of the connector **260** locks into engagement with the internal structure of the receptacle **262**, the trailing edge **265** of the dust cover **261** clears the edge of the opening **263** of the receptacle **262**. This releases the compression of the trailing edge **265** of the dust cover **261** which springs down into the opening **263** of the receptacle **262**. Thus, the vertical face of the trailing edge **265** of the dust cover **261** fits against the edge of the opening **263** of the receptacle **262** so as to form a secondary lock in addition to the primary lock of the structure of the connector **260** in engagement with the internal structure of the receptacle **262**. In addition to sealing against the entry of debris into the receptacle **262**, the secondary lock formed by the dust covers **261** in engagement with the opening **263** of the receptacle **262**, provides additional resistance against the undesired unlocking rotation of the installed cleat in high torque environments such as with baseball cleats.

FIG. 27 also shows a receptacle **262** with a receptacle cover **266** having a cover spring **267** which extends into a receptacle cavity defined by the receptacle openings **263**. The receptacle spring **267** performs two functions similar to that of the dome **94** in FIGS. 14 and 15. First, when a cleat connector **260** is installed so as to engage the structure of the receptacle **262**, the receptacle spring **267** is compressed and thereby exerts a downward pressure on the cleat connector **260** which increases the contacting force between the connector **260** and the receptacle **262**. Second, when the cleat is rotated for removal from

the receptacle **262** (*e.g.*, for replacement), the receptacle spring supplies an ejecting force on the cleat connector **260** which aids in disengaging the cleat connector **260** from the receptacle **262**.

These functions do not necessarily require the use of a dome **94** as in FIGS. 14 and 15, or a spring **267** as in FIG. 27. FIG. 29 shows a receptacle cover **268** having a center cone **269**. The cone **269** performs the same functions as the previously discussed dome **94** and spring **267**. In addition, the size and strength of the cone **269** may be relatively substantial when the cleat connector **260** contains a similarly shaped mating depression **270**, shown in FIGS. 25 and 26.

It should be realized that while the various preferred embodiments of cleat receptacles differ in the complexity of their specific structures, this does not significantly restrict the materials which may be used to fabricate such receptacles. All or part of a receptacle may be fabricated from metal. Alternatively, all or part of receptacle may be fabricated from a synthetic material such as plastic or nylon. Metal offers great strength, but with relatively great weight. Synthetic materials may be relatively lighter, while somewhat less strong than metal. Either metal or synthetic materials may, however, be employed satisfactorily.

In the preceding description and following claims, the term "cleat" is consistently used, however, no distinction is intended to be created between cleats and spikes, nor should any be inferred. In addition, while preferred embodiments have been described in which a cleat may be removably attached to a shoe using the described connectors and receptacles, the use of such connectors and receptacles is not limited to attaching cleats to shoes, but may be generally employed as a removably attachable connector system in other applications which require the attachment of one mechanical structure to another. Similarly, it is of course apparent that the present invention is not limited to the detailed description set forth above. Various changes and modifications of this invention as described will be apparent to

those skilled in the art without departing from the spirit and scope of this invention as defined in the following claims.

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